Shear History Extensional Rheology Experiment (SHERE)

PI: Prof. Gareth McKinley, MIT
PS/PM: Nancy R. Hall, NASA GRC
Engineering Team: ZIN Technologies, Inc.

Glenn Research Center

Objective:

- To investigate of the effect of preshearing on the stress/strain response of a polymeric liquid being stretched in microgravity.
  - Will investigate a controlled preshear history (from no preshear to very strong preshear) for a specified period. Then shear flow is halted and followed by exponentially increasing elongation profile axially to the polymeric liquid.

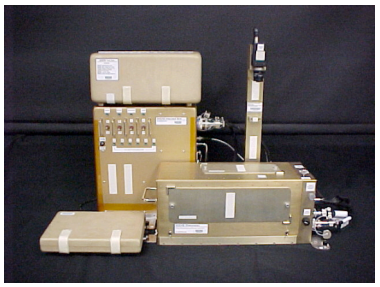
Relevance/Impact:

- Allows optimization of polymer processing operations that involved *complex flows*, i.e., both *shearing* ("rotation") and *elongation* ("stretching").
- Provide engineering design tools to optimize polymeric manufacturing processes.

Development Approach:

- Flight experiment and design leverages off of the Extensional Rheology Experiment (ERE) sounding rocket experiment which studied the uniaxial stretching flow of a polymeric liquid.
- Protoflight approach used for flight hardware development.
- A high fidelity operational trainer is available.
- Experiment is set up and run by an astronaut. Some telemetry is viewed on the ground.

SHERE hardware in GBX



SHERE flight hardware

ISS Resource Requirements

Accommodation (carrier)	Microgravity Science Glovebox
Upmass (kg) (w/o packing factor)	29.1 - Main Hardware (on orbit) 7.2 - Fluid Module stowage Tray (on orbit) 7.3 - Fluid Module Stowage Tray
Volume (m^3) (w/o packing factor)	0.100 - Main Hardware (on orbit) 0.012 - Fluid Module stowage Tray
Power (kw) (peak)	0.085
Crew Time (hrs) (installation/operations	33 crew time
Autonomous Ops (hrs)	24
Launch/Increment	10A (Node 2) - Main Hardware 1J/A (Middeck) - Fluid Module stowage Tray ULF-2 (Middeck) - Fluid Module stowage Tray

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	Design Rvw	VRR	Ph III FSR	FHA	Launch	Ops	Return	Final Report
Main hardware	**N/A**	**N/A**	**N/A**	**12/2000**	**N/A**	**2Q07**	**4/07**	**10/07**	**Inc. 17**	**ULF-2**	**n/a**
Fluid Modules (20)	**N/A**	**N/A**	**N/A**	**12/2000**	**N/A**	**2Q07**	**3/08**	**4/08**	**Inc. 17**	**ULF-2**	**8/2010**
Fluid Modules (25)	**N/A**	**N/A**	**N/A**	**8/2008**	**N/A**	**4Q08**	**10/08**	**11/08**	Inc. 18	**STS 119**	**8/2010**
Documentation Revision Date: 8/2009	Website: http://spaceflightsystems.grc.nasa.gov/Advanced/ISSResearch/MSG/SHERE/ eRoom: SHERE				SRD: signed, in eroom EDMP:			Project Plan: in eroom SEMP: N/A			